## REMARKS

### I. Introduction

Applicant's representative gratefully acknowledges his discussion with the Examiner by telephone, on or about October 17, 2002, when the Examiner indicated that claims 5 – 8 would be allowable upon a satisfactory treatment of pending issues under section 112, second paragraph. Further, the Examiner suggested claim amendments to obviate the references addressed below. With the Examiner's suggestions in mind, Applicant respectfully requests reconsideration of the present application in view of the foregoing amendments and in the following exposition.

### II. Status of and Amendments to the Claims

Upon entry of the claim revisions set forth above, claims 1 – 16 will be pending. Claims 1, 5, 9, and 13 are amended solely for the sake of clarify, by deleting the phrase "at least sufficient." Additionally, claims 9, 11 – 13, 15 and 16 are amended to replace the term "processed fluid" with "oil." Support for this amendment can be found in the specification at page 2, lines 14 – 15. Since revisions introduce no new matter, Applicant requests that they be entered.

### III. The Office Action

#### A. Rejection of Claims Under 35 U.S.C. § 112, Second Paragraph

Claims 1 – 16 stand rejected on several grounds of alleged indefiniteness. Office Action at page 2. Applicant respectfully traverses this rejection, insofar as it might be applied to the amended claims.

##### 1. "At least sufficient"

In the Examiner's opinion, the phrase "at least sufficient" renders unclear the quantity recited in claims 1, 5, 9, and 13. In response, the claims are amended to remove the phrase "said compound being added in a quantity at least sufficient to complex iron sulfide in said dry pipe line." Thus, Applicant submits that the claims are no longer indefinite, rendering moot this ground for rejection.

2. **"Dry Gas" and "Dry Gas Pipeline"**

According to the Examiner, the skilled person would not apprehend the metes and bounds of the phrases "dry gas" and "dry gas pipeline" in claims 1 and 5. Applicant cannot agree with the Examiner's unsubstantiated assertions.

"Dry gas" is understood very well by persons of ordinary skill in the petroleum arts. For example, the U.S. Department of Energy, referring to "[o]il and natural gas . . . as the lifeblood of the U.S. economy," defines "dry gas" as "[n]atural gas from the well that is free of liquid hydrocarbons; gas that has been treated to remove all liquids making it suitable for shipping in a pipeline." *See* Exhibit 1 (*DOE – Fossil Energy: Education – Glossary* at DOE Fossil Energy – Oil and Natural Gas Research and Development; http://www.fossil.energy.gov/education/glossary.html). This definition naturally recognizes a "pipeline" as the conduit through which "dry gas" is shipped. This evidence shows that persons knowledgeable of the petroleum industry would harbor no uncertainty at all over the terms and equipment pertinent to the "lifeblood of the U.S. economy." Accordingly, Applicant respectfully requests the Examiner to withdraw this rejection.

2. **On-line or Off-line Treatment**

The Examiner alleges claims 1 and 5 to be indefinite for not specifying whether the "pipeline is being treated online *or* off-line with the composition." Office Action at page 2 (emphasis supplied). Yet claims 1 and 5 clearly define a method of treating a dry gas pipeline that contains iron sulfide deposits, regardless of that pipeline's operational status. There is no indefiniteness simply because the claims do not prescribe one of two operational states of the Examiner's choosing. Accordingly, Applicant requests the Examiner to withdraw this rejection.

3. **Iron Sulfide in the Pipeline**

The Examiner considers claims 1, 5, 7, and 13 to be unclear for failing to "positively recite the pipeline having iron sulfide therein." Applicant courteously disagrees. Claims 1 and 5 refer plainly to "complexing iron sulfide *found in said dry gas pipe lines*"; similarly, claims 9 and 13, as amended, refer to "complexing iron sulfide

*found in said oil pipe line*" (emphases supplied). Thus, the claims clearly and affirmatively apprise the person of ordinary skill that iron sulfide is "found" in the recited pipe lines. Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw this rejection.

#### 4. "Processed Fluid" and "Processed Fluid Pipeline"

Claims 9 and 11 stand rejected as being indefinite for reciting "processed fluid" and "processed fluid pipeline." In the Examiner's opinion, a person of ordinary skill in the art would not know the meaning of these terms. Without acquiescing to the Examiner's position, Applicant has chosen to advance prosecution by revising the claims to replace "processed fluid" with "oil." Claims 12, 13, 15, and 16 are amended similarly, for consistency. Applicant submits that skilled persons in the petroleum arts understand "oil" to have a clear and definite meaning. Accordingly, Applicant respectfully submits that the amendments to the claims render this rejection moot.

### B. Rejection of Claims Under 35 U.S.C. § 102(b)

#### 1. Larsen *et al.*

Claims 1, 3, 4, 9, 11, and 12 stand rejected under 35 U.S.C. § 102(b) as being allegedly anticipated by the publication Corrosion 2000 by Larsen *et al.* ("Larsen"). Office Action at page 3.

#### a. The Examiner's Basis for Rejection

In support of this rejection, the Examiner characterizes Larsen as teaching the dissolution of iron sulfide by [tetrakis(hydroxymethyl)phosphonium] sulfate ("THPS") in oil field pipelines purported to carry oil, water, and gas. The Examiner hinges this rejection on the alleged indefiniteness of the terms "dry gas" and "processed fluid." Thus, the hydrogen sulfide and gas produced by the oil field of the reference purportedly meets the claim limitation of "dry gas." Similarly, the Examiner considers fluid to be a gas or liquid, and thus concludes the "oil, gas, with water present" of Larsen to meet the "processed fluid" limitation of the claims. Finally, Larsen

purportedly discloses long term batch and pulsed treatments of THPS. To the extent this rejection may apply to the claims as amended, Applicant respectfully traverses.

**b. Larsen Does Not Teach or Suggest Addition of THPS Compositions to Dry Gas or Oil Pipelines**

As it pertains to iron sulfide, the disclosure of Larsen is limited to the dosing of THPS into *injection waters* that are delivered to sub-oceanic oil wells, for the purpose of controlling iron sulfide deposits "restricting injection flow rates and reducing oil production rates." *See* Larsen at page 13 ("Control of Iron Sulfide"). *Id.* at Table 2. For example, Figure 3 of Larsen graphically illustrates that injection water is introduced to and permeates through a fractured and fissured oil reservoir, finally emerging as produced water through a production well. In this context, Larsen discloses that fine iron sulfide particles readily block formation rock, thereby attenuating *water* injection rates. *Id.* at page 17. As noted by the Examiner, Larsen teaches that iron sulfide removal occurred in pipes downstream of the THPS dosing point. Thus, the only nexus in Larsen between iron sulfide reduction by THPS in pipelines is the wholly aqueous environment within the water injection well.

By contrast, Larsen does not teach the addition of THPS compositions to dry gas or oil pipelines as claimed in order to complex iron sulfide deposits. As discussed above, dry gas is "[n]atural gas from the well that is free of liquid hydrocarbons; gas that has been treated to remove all liquids making it suitable for shipping in a pipeline." Exhibit 1. Larsen is limited to THPS dosing into injection *waters*. Clearly, the injection waters of Larsen cannot be equated with the recited dry gas, whether the gas is natural gas or gas free of "all liquids." Similarly, the injection waters disclosed by the reference do not meet the "oil" limitation of the claims.

Because Larsen does not teach or suggest each and every element of the claims, it is not available as prior art under section 102. Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw this rejection.

**2. Odell *et al.***

Claims 9, 10, 13, and 14 stand rejected under 35 U.S.C. § 102(b) as being allegedly anticipated by WO 00/21892 to Odell *et al.* ("Odell"). Office Action at page 4. Applicant respectfully traverses this rejection to the extent that it might apply to the claims as amended.

**a. The Examiner's Basis for Rejection**

In the Examiner's opinion, Odell discloses the treatment of iron sulfide deposits within oil wells with aqueous tetrakis(hydroxymethyl) phosphonium chloride or sulfate together with ammonium salts. The Examiner conditions this rejection on the alleged indefiniteness of the term "processed fluid pipeline," which purportedly circumscribes the "oil well" of Odell.

**b. Odell Does Not Teach or Suggest Addition of THPS or its Chloride Analog to Oil Pipelines**

Consistent with the Examiner's general impressions, Odell teaches an aqueous composition (solution) comprising a tetrakis(hydroxymethylphosphonium) salt, an ammonium salt, and an acid to maintain the pH below 4.5. *See* Odell at page 2, line 6 – 19 (external numbering in the reference). The salt can be a sulfate or chloride salt, among others. *See* id. at page 2, lines 33 – 38. Odell discloses that iron sulfide "forms extensive deposits in oil wells, obstructing the flow through wells and adjacent strata." Id. at page 1, lines 24 – 26. Odell further teaches that the composition described above "may be added directly to alkaline, neutral or weakly acidic *water systems* . . . to dissolve or leach divalent metal." Id. at page 5, lines 19 – 21 (emphasis supplied). Thus, an exemplary composition comprising THPS, ammonium sulfate, and sulfuric acid was "dosed to an alkaline *formation water* in an oil well obstructed with ferrous sulfide deposits" to dissolve the ferrous sulfide. Id. at page 5, lines 35 – 45.

Odell does not teach or suggest treating an oil pipeline having iron sulfide *via* the addition of THPS or the chloride salt analog with an ammonium salt. The general and exemplary teachings of Odell are limited to the use of tetrakis(hydroxymethyl)-phosphonium salts in *aqueous* environments, i.e., water systems. Because the formation water of Odell is not – in fact, cannot be – oil as claimed, Odell does not

meet each and every limitation of the claims. Thus, Odell is not available as prior art under section 102. Accordingly, Applicant courteously requests the Examiner to reconsider and withdraw this rejection.

C. **Rejection of Claims Under 35 U.S.C. § 103(a)**

1. **Larsen**

Claims 2 and 10 stand rejected under 35 U.S.C. § 103(a) as being allegedly obvious over Larsen. Office Action at pages 4 – 5.

a. **The Examiner's Basis for Rejection**

In support of this rejection, the Examiner concedes that Larsen does not specifically recite the claimed 5% by weight concentration of THPS. Relying upon Larsen's disclosure that THPS at certain enumerated concentrations dissolves iron sulfide, the Examiner considers that the claimed concentration would have been obvious to an artisan of ordinary skill. Since Larsen purportedly teaches the general provision of varying THPS concentrations, it would have been within the purview of the artisan to discover the claimed 5% THPS concentration. Applicant respectfully traverses this rejection.

b. **Larsen Teaches Away from the Claimed THPS Concentration**

For the reasons discussed above in the response to the section 102 rejection, Larsen simply does not teach or suggest each and every claim limitation. Thus, the reference is unavailable as prior art under section 102. Consequently, Larsen is also unavailable as prior art under section 103.

Moreover, Larsen actually teaches away from the claimed 5% concentration of THPS. The Examiner notes correctly the range of THPS concentrations disclosed by Larsen. Referring to Table 3 of Larsen, THPS was dosed into the influent stream of an oil platform separator vessel in concentrations ranging from 8 to 20 mg/L.[1] Citing the

[1] Laboratory experiments used THPS at concentrations as high as 100 mg/L. *See* Larsen at page 17, Table 3.

presence of ammonium ions as being critical to iron sulfide dissolution by THPS, *see* Larsen at p. 16, first paragraph, Larsen notes that "both Skjold and Gorm produced waters contain approximately 30 mg/L ammonium ions and *so this would not be a limiting factor.*" Id. at page 17 and footnote to Table 3 (emphasis supplied).

Confronted with these general teachings, the artisan of ordinary skill would well conclude that in some circumstances the ammonium concentration in the water *would* be a limiting factor to the concentration of THPS used to solubilize iron sulfide. Thus, turning to Larsen for guidance along these lines, that person would immediately apprehend the upper concentration of 20 mg/L THPS (0.002% by weight) used in actual practice. *Id.* at Table 3, last column. Additionally, laboratory trials employed THPS in concentrations no higher than 100 mg/L (0.01% by weight) in the presence of 30 mg/L (0.003% by weight) ammonium ions. Finally, Larsen discloses other laboratory trials using solutions of 1% THPS and 0.1% ammonium chloride. *Id.* at page 17, first paragraph.

The claimed 5% concentration of THPS represents a 5-fold increase of the highest experimental concentrations (1%) disclosed by Larsen. However, under the conditions prescribed by the "produced waters" in the reference, i.e. *water where the concentration of ammonium ion is limited to 30 mg/L*, the claimed THPS concentration represents a *500-fold* increase of the experimental (0.01%) and a *2500-fold* increase of the offshore (0.002%) concentrations taught by Larsen. Thus, Larsen is limited to aqueous environments where the ammonium ion concentration militates against practical concentrations of THPS no higher than 1/2500$^{th}$ of the claimed THPS concentration. Consequently, the person of skill in the art would have no reason whatsoever to increase the THPS concentration taught by Larsen to reach the claimed 5% concentration because the concentration of ammonium ions of the reference would render it wholly impractical to do so.

In sum, Larsen does not teach or suggest the claimed invention. Furthermore, a person of ordinary skill in the art, armed with Larsen, would have not been motivated to adjust the THPS concentration far above the point Larsen fairly suggests as possible to reach the claimed THPS concentration of 5%. Therefore, Applicant respectfully

submits that Larsen does not obviate claims 2 and 10, and requests the Examiner to reconsider and withdraw this rejection.

### 2. Odell

Claims 11, 12, 15, and 16 stand rejected under 35 U.S.C. § 103(a) as being allegedly obvious over Odell. Office Action at page 5.

#### a. The Examiner's Basis for Rejection

The Examiner cites Odell for the purported suggestion that tetrakis(hydroxymethyl)phosphonium sulfate can be dosed continuously or intermittently to an oil well. Specifically, the Examiner refers to Example 1, prescribing such dosing "at a rate equivalent to 100 ppm THPS." Applicant respectfully traverses this rejection.

#### b. Odell Does Not Teach or Suggest the Claimed Invention

As discussed above in response to the section 102(b) rejection, Odell teaches the treatment of iron sulfide deposits in oil wells by dosing THPS or related salts and an ammonium salt to alkaline *formation water.* Because formation water does not meet the claimed limitation of "oil," Odell is unavailable as prior art under section 102, and thus is unavailable under section 103. Therefore, the Examiner's allegation of Odell rendering obvious the claimed intermittent or continuous dosing of tetrakis(hydroxymethyl)phosphonium salts is moot. Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw this rejection.

## IV. Conclusion

Having addressed the outstanding issues, Applicant submits that the present application is in condition for allowance, and he requests an early notice to this effect. Should the Examiner feel that a telephone interview would advance prosecution, she is invited to contact the undersigned.

Respectfully submitted,

Date 24 January 2003 By S. A. Bent

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## MARKED UP VERSION SHOWING CHANGES MADE

1. (Amended) A method of treating a dry gas pipe line susceptible to the build up of iron sulfide deposits by complexing iron sulfide found in said dry gas pipe lines, the method comprising adding to said dry gas pipe line a composition comprising: water, [tetrakis (hydroxymethyl) phosphonium] sulfate and a soluble ammonium salt[, said compound being added in a quantity at least sufficient to complex iron sulfide in said dry pipe line].

5. (Amended) A method of treating a dry gas pipe line susceptible to the build up of iron sulfide deposits by complexing iron sulfide found in said dry gas pipe lines, the method comprising adding to said dry gas pipeline a composition comprising: water, [tetrakis (hydroxymethyl) phosphonium] chloride and a soluble ammonium salt[, said compound being added in a quantity at least sufficient to complex iron sulfide in said dry pipe line].

9. (Amended) A method of treating [a processed fluid] **an oil** pipe line susceptible to the build up of iron sulfide deposits by complexing iron sulfide found in said [processed fluid] **oil** pipe line, the method comprising adding to said [processed fluid] **oil** pipe line a composition comprising: water, [tetrakis (hydroxymethyl) phosphonium] sulfate and a soluble ammonium salt[, said compound being added in a quantity at least sufficient to complex iron sulfide in said processed fluid pipe line].

11. (Amended) The method of claim 9 wherein said composition is added continuously to said [processed fluid] **oil** pipe line.

12. (Amended) The method of claim 9 wherein said composition is added intermittently to said [processed fluid] **oil** pipe line.

13. (Amended) A method of treating [a processed fluid] **an oil** pipe line susceptible to the build up of iron sulfide deposits by complexing iron sulfide found in said [processed fluid] **oil** pipe line, the method comprising adding to said [processed fluid] **oil** pipeline a composition comprising: water, [tetrakis (hydroxymethyl) phosphonium] chloride and a soluble ammonium salt[, said compound being added in a quantity at least sufficient to complex iron sulfide in said processed fluid pipe line].

15. (Amended) The method of claim 13 wherein said composition is added continuously to said [processed fluid] **oil** pipe line.

16. (Amended) The method of claim 13 wherein said composition is added intermittently to said [processed fluid] **oil** pipe line.

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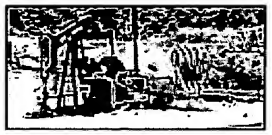

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# Glossary

**ANTHRACITE:** A hard, jet black substance with a high luster. It is the highest rank of coal, almost purely carbon. It is primarily mined in northeast Pennsylvania.

**ASSOCIATED GAS:** Gas combined with oil. Known also as gas cap gas and solution gas, it provides the force (also called the drive mechanism) needed to force oil to the surface of a well. Associated gas is normally present in an oil reservoir in the early stages of production.

**BARREL:** The standard unit of measure of liquids in the oil industry; it contains 42 U.S. standard gallons.

**BASIN:** A depression of the earth's surface into which the sediments that can form oil and natural gas are deposited; a broad area of the earth beneath which layers of rock are inclined, usually from the sides toward the center.

**BITUMINOUS COAL:** Most common type of solid fossil fuel. It is soft, dense, and black with well defined bands of bright and dull material. It is mined chiefly east of the Mississippi River.

**BLOWOUT:** An uncontrolled flow of gas, oil, or other fluids from a well into the air. A well may blow out when pressure deep in the reservoir exceeds the weight of the column of drilling fluid inside the well hole.

**BLOWOUT PREVENTER:** A special assembly of heavy-duty valves installed on top of a well which can be closed to prevent high-pressure oil or gas from escaping (a blowout) from the well hole during drilling operations.

**BOILER:** A tank in which water is heated by burning a fuel like coal, natural gas, or oil to produce steam for spinning a steam turbine to generate electricity or for use in a variety of industrial manufacturing processes.

**BOREHOLE:** The hole in the earth made by the drill; the uncased drill hole from the surface to the bottom of the well.

**Btu (BRITISH THERMAL UNIT):** A standard unit for measuring the quantity of heat required to raise the temperature of 1 pound of water by 1 degree F.

**CARBON DIOXIDE:** A colorless, odorless gas that is produced when animals (including humans) breathe or when carbon-containing materials (including fossil fuels) are burned. Carbon dioxide is essential to the photosynthesis process that sustains plant and animal life, however, it can accummulate in the air and trap heat near the Earth's surface (the "greenhouse effect").

**CASING:** Steel pipe used in oil wells to seal off fluids in the rocks from the bore hole and to prevent the walls of the hole from caving.

**CLEAN COAL TECHNOLOGIES:** New ways to burn or use coal that significantly reduce the release of pollutants and offer greater environmental protection and, often, better economic performance than older coal technologies.

**COAL:** A black or brownish-black solid combustive substance formed by the partial decomposition of vegetable matter without access to air.

**COKE:** A hard, dry carbon substances produced by heating coal to a very high temperature in the absence of air. Coke is used in the manufacture of

iron and steel.

**COMBUSTOR:** The part of a boiler or a turbine in which fuel is burned.

**CRUDE OIL:** Unrefined petroleum that reaches the surface of the ground in a liquid state.

**DIRECTIONAL DRILLING:** The technique of drilling at an angle from the vertical by deflecting the drill bit. Directional wells are often drilled to reach an oil- or gas-bearing reservoir where drilling cannot be done, such as beneath a shipping lane in the ocean. Directional drilling is being used increasingly to intersect reservoirs at angles that exposes more of the rock to the wellbore and increases the amount of oil or gas that flows into the well.

**DRAGLINE:** A coal mining machine that uses a bucket operated and suspended by lines or cables, one of which lowers the bucket from the boom; the other, from which the name of the machine is derived, allows the bucket to swing out from the machine or to be dragged toward the machine to remove the ground above a coal seam (called overburden).

**DRILL CUTTINGS:** Chips and small fragments of drilled rock that are brought to the surface by the flow of the drilling mud as it is circulated.

**DRILL PIPE:** Heavy, thich walled, hollow steel pipe used in rotary drilling to turn the drill bit and to provide a conduit for the drilling mud.

**DRILLING MUD:** A special mixture of clay, water, or refined oil, and chemical additives pumped downhole through the drill pipe and drill bit. The mud cools the rapidly rotating bit; lubricates the drill pipe as it turns in the well bore; carries rock cuttings to the surface; serves as a plaster to prevent the wall of the borehole from crumbling or collapsing; and provides the weight or hydrostatic head to prevent extraneous fluids from entering the well bore and to control downhole pressures that may be encountered.

**DRY HOLE:** A well drilled to a certain depth without finding commercially exploitable hydrocarbons.

**DRY GAS:** Natural gas from the well that is free of liquid hydrocarbons; gas that has been treated to remove all liquids making it suitable for shipping in a pipeline.

**ELECTROSTATIC PRECIPITATOR:** An electrically charged device for removing fine particles (fly ash) from combustion gases prior to the release from a power plant's stack. The device passes combustion gases through positively and negatively charged plates that attract the tiny particles using static electricity.

**EXPLORATION:** The process of searching for minerals, like oil and gas, before development and production. Exploration activities include (1) geophysical surveys, (2) drilling to locate an oil or gas reservoir, and (3) the drilling of additional wells after a discovery to determine the boundaries of an underground reservoir. It enables an oil or gas company to determine whether to proceed with development and production.

**FLUIDIZED BED COMBUSTION:** An advanced way of burning crushed coal (or other fuels) by suspending the coal on a upward stream of hot air. In the fluid-like mixing process, limestone can be injected into the "bed" (floating layer) of coal to absorb sulfur pollutants before they can escape out the smokestack. The mixing process also lowers the temperature of the burning coal below the point where nitrogen oxides, another pollutant, are formed.

**FOSSIL FUEL:** Any naturally occurring fuel of an organic nature formed

by the decomposition of plants or animals; includes coal, natural gas, and petroleum.

**FIELD:** A geographical area in which one or more oil or gas wells produce. A single field may include several reservoirs separated either horizontally or vertically.

**GASIFICATION:** A group of processes that turn coal into a combustible gas by breaking apart the coal using heat and pressure and, in many cases, with hot steam.

**GREENHOUSE EFFECT:** The warming of the Earth's surface and lower atmosphere caused by the trapping of radiated heat, much the same way the coated window panes of a agricultural greenhouse keep heat inside the greenhouse. Several gases, like carbon dioxide and methane, can keep heat from escaping from the Earth into space and are called "greenhouse gases."

**HYDROCARBONS:** A class of compounds containing hydrogen and carbon formed by the decomposition of plant and animal remains. These compounds include coal, oil, natural gas, and other substances occurring in rocks.

**LIQUEFACTION:** Processes that convert coal into a liquid fuel, similar in nature to crude oil and/or refined products.

**LIGNITE:** The lowest rank of coal, which is brownish-black and has a high moisture content. Used mainly to generate electricity, it is mined in Montana, North Dakota, and Texas.

**METALLURGICAL COAL:** The type of coal which is converted to coke for use in manufacturing steel; often referred to as coking coal.

**METHANE:** A colorless, odorless gas that is the most simple of the hydrocarbons formed naturally from the decay of organic matter. Each methane molecule contains a carbon atom surrounded by four hydrogen atoms. It is the principal component of natural gas.

**NATURAL GAS:** A mixture of gaseous hydrocarbons, composed primarily of methane, occurring naturally in the Earth - often among petroleum deposits - that is used as a fuel.

**NONASSOCIATED GAS:** Dry gas that is not associated with oil in a productive reservoir, as opposed to associated gas or solution gas.

**OIL PRODUCTS:** Products ready for consumption through the processing of crude oil and natural gas. Refined products include jet fuel, kerosene, waxes, asphalt, motor gasoline, petrochemical feedstocks, lubricants, etc.

**OUTER CONTINENTAL SHELF(OCS):** All submerged lands seaward and outside the area of lands beneath navigable waters. Lands beneath navigable waters are interpreted as extending from the coastline 3 nautical miles into the Atlantic Ocean, the Pacific Ocean, the Arctic Ocean, and the Gulf of Mexico excluding the coastal waters off Texas and western Florida.

**OVERBURDEN:** Layers of earth and rock covering a coal seam. In surface mining operations, overburden is removed using large equipment and is either used to backfill areas previously mined or is hauled to dumping areas.

**OZONE:** A bluish, toxic gas with a pungent odor formed by three oxygen atoms rather than the usual two. Ozone occures in the stratosphere and plays a role in filtering out ultraviolet radiation from the sun's rays. At ground level ozone is a major component of smog.

**PEAT:** A dark brown or black deposit resulting from the partial decomposition of vegetative matter in marshes and swamps.

**PETROLEUM:** A term applied to crude oil and oil products in all forms.

**PROVED RESERVES:** The estimated quantities of crude oil and natural gas in the ground that geological data demonstrate with reasonable certainty to be recoverable under existing economic conditions with current recovery technology.

**RESERVES IN PLACE:** The amount of oil or gas physically contained in a reservoir (a place - usually totally underground -where oil or natural gas has collected naturally over millions of years). The "proved reserves" may only be 15 to 35 percent of the "reserves in place."

**SCRUBBER:** A device that removes gaseous pollutants from the combustion gases of burning fuels, typically by spraying into the gases a mixture of water and special chemicals (like lime or limestone) that will absorb the pollutants. Scrubbers are primarily used to remove sulfur pollutants from the combustion gases of coal burning.

**SUBBITUMINOUS COAL:** A dull, black coal often referred to as black lignite. It is used for generating electricity and space heating. It ranks between bituminous and lignite and is mined in the western U.S.

**TURBINE:** A machine that has propellar-like blades which can be moved by flowing gas (such as steam or combustion gases) to spin a rotor in a generator to produce electricity.

**UNIT TRAIN:** A train, typically consisting of approximately 100 cars, which is dedicated to the transport of a single commodity such as coal.

**WELL:** A hole drilled or bored into the earth, usually cased with metal pipe, for the production of gas or oil. A hole for the injection under pressure of water or gas into a subsurface rock formation.

**WORKOVER:** Operation on a shut-in or producing well to restore or increase its production.

START